Honors Physics Electrostatics HW, part 1 (Homework)

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Include file name: Physics_Worksheet_0064
Price: $3

1.
A 31 g piece of aluminum that was originally electrically neutral is given a charge of +6.8 μC.
(a) How many electrons were removed from the aluminum in the charging process?
(b) What fraction of the electrons originally in the aluminum were involved in the charging process?

2.
Two identical conducting spheres are placed with their centers 0.28 m apart. One is given a charge of 6×10^{-9} C and the other a charge of -10×10^{-9} C.
(a) Find the electrostatic force exerted on one sphere by the other.
(b) The spheres are connected by a conducting wire. After equilibrium has occurred, find the electrostatic force between the two.

3.
The nucleus of ^{8}Be, which consists of four protons and four neutrons, is very unstable and spontaneously breaks into two alpha particles (helium nuclei, each consisting of two protons and two neutrons).
(a) What is the force between the two alpha particles when they are 3.60×10^{-15} m apart, and
(b) what will be the magnitude of the acceleration of the alpha particles due to this force?

4.
An electron is released a short distance above the surface of the Earth. A second electron directly below it exerts an electrostatic force on the first electron just great enough to cancel the gravitational force on it. How far below the first electron is the second?

5.
Two small metallic spheres, each of mass 0.20 g, are suspended as pendulums by light strings from a common point, as shown in Figure P15.9. The spheres are given the same electric charge, and it is found that the two come to equilibrium when each string is at an angle of 7.0° with the vertical. If each string is 30.0 cm long, what is the magnitude of the charge on each sphere?

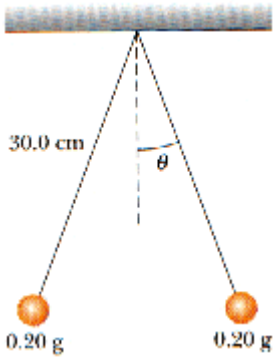

Figure P15.9.

6.
Three charges are arranged as shown in Figure P15.11. Find the magnitude and direction of the electrostatic force on the charge at the origin.

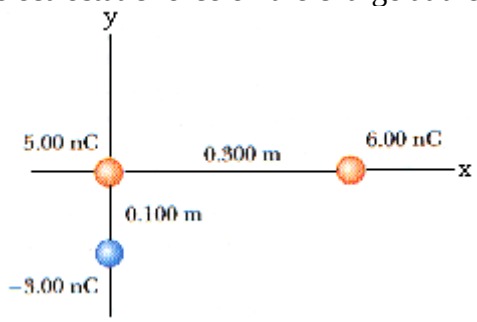

Figure P15.11

7.
A charge of 5.00 ×10-9 C and a charge of -2.50 ×10-9 C are separated by a distance of 60.0 cm. Find the position at which a third charge, of 13.0 ×10-9 C, can be placed so that the net electrostatic force on it is zero.

8.
In a hydrogen atom, what are the magnitude and direction of the electric field set up by the proton at the location of the electron (0.51 ×10-10 m away from the proton)?

9.
(a) Find the electric field at a point midway between two charges of +31.0 ×10-9 C and +65.0 ×10-9 C, separated by 32.0 cm;
What is the direction of the electric field?

(b) Find the electric field at a point midway between two charges of +31.0 ×10-9 C and -65.0 ×10-9 C, separated by 32.0 cm.
What is the direction of the electric field?

10.
A piece of aluminum foil of mass 4.70 ×10-2 kg is suspended by a string in an electric field directed vertically upward. If the charge on the foil is 2.70 μC, find the strength of the field that will reduce the tension in the string to zero.

11.
A proton accelerates from rest in a uniform electric field of 600 N/C. At some later time, its speed is 1.40 ×106 m/s.
(a) Find the magnitude of the acceleration of the proton.
(b) How long does it take the proton to reach this speed?
(c) How far has it moved in this interval?
(d) What is its kinetic energy at the later time?

12.

Positive charges are situated at three corners of a rectangle, as shown in Figure P15.23. Find the electric field at the fourth corner.

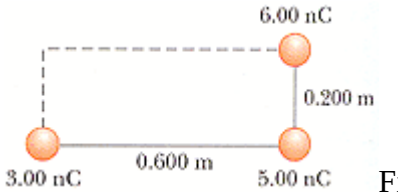

Figure P15.23.

13.
Each of the electrons in a particle beam has a kinetic energy of 1.6 ×10-17 J.
(a) What is the magnitude of the uniform electric field (pointing in the direction of the electrons' movement) that will stop these electrons in a distance of 10 cm?
(b) How long will it take to stop the electrons?
(c) After the electrons stop, what will they do? Explain.

14.
In Figure P15.27, determine the point (other than infinity) at which the total electric field is zero.

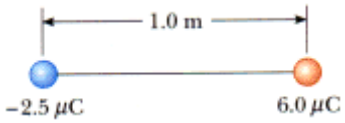

Figure P15.27.

15.
(a) Sketch the electric field lines around an isolated point charge, $q > 0$.
(b) Sketch the electric field pattern around an isolated negative point charge of magnitude $-2q$.
The sketches are not included in the answers.

◉ nothing in particular